IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
HENDERSON ET AL.

Serial No. **Not Yet Assigned**

Filing Date: **Herewith**

For: **METHOD OF DETECTING FLICKER AND VIDEO CAMERA USING THE METHOD**

I HEREBY CERTIFY THIS PAPER OR FEE IS BEING DEPOSITED WITH THE U.S. POSTAL SERVICE "EXPRESS MAIL POST OFFICE TO ADDRESSEE" SERVICE UNDER 37 CFR 1.10 ON THE DATE INDICATED BELOW AND IS ADDRESSED TO: BOX PATENT APPLICATIONS, ASSISTANT COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231.

EXPRESS MAIL NO: EL747059405US

DATE OF DEPOSIT: August 24, 2001

NAME: Jennifer Ferguson

SIGNATURE: Jennifer Ferguson

PRELIMINARY AMENDMENT

Director, U.S. Patent and Trademark Office
Washington, D.C. 20231

Sir:

Prior to the calculation of fees and examination of the present application, please enter the amendments and remarks set out below.

In the Drawings:

Submitted herewith is a request for a proposed drawing modification as indicated in red ink to reposition the reference labels in FIG. 1 and to remove an extraneous marking therefrom. In addition, FIGS. 2, 3 and 4 are also being modified as indicated in red ink to remove extraneous markings therefrom.

In the Specification:

Please add the following new paragraphs beginning at page 3, line 27 in the "Summary of the Invention" section:

-- This and other objects, advantages and features of the present invention are provided by a method for

detecting lighting flicker in an output of a video imaging device having a main picture area comprising an array of pixels for producing successive images at a frame rate. The method preferably comprises producing a series of signals from at least one additional picture area adjacent the main picture area. The at least one additional picture area has a size substantially larger than a pixel, with each signal being a function of light incident on the at least one additional picture area in a time period substantially shorter than the frame rate. A predetermined number of the series of signals ar accumulated to form a series of compound samples, and the series of compound samples are filtered to detect components indicating the flicker.

The time period may be equivalent to a line rate of the main picture area. The filtering may be performed by a bandpass filter tuned to a frequency of the flicker. Each compound sample may be formed at a sample rate which is a multiple of a nominal flicker frequency, and wherein the filtering comprises taking a fundamental output component of a radix-N butterfly. The method preferably further includes selecting an exposure setting for the main picture area for reducing the flicker.

Another aspect of the present relates to a flicker-detecting video camera comprising a main picture area comprising an array of pixels for producing successive images at a frame rate, and at least one additional picture area adjacent the main picture area. The at least one additional picture area may have a size substantially larger than a pixel, and the at least one additional picture area may be arranged for producing a series of signals each of which is a function of light incident on the at least one additional

picture area in a time period substantially shorter than that of the frame rate.

The video camera preferably further includes an accumulator circuit for accumulating a predetermined number of the series of signals to form a series of compound samples, and a filter for filtering the series of compound samples for detecting components indicating the flicker.

The at least one additional picture area may be defined by a strip of pixels down one side of the array. In one embodiment, the strip of pixels is a column of pixels of the array, with each pixel in the column being connected together.

The video camera may further comprises an automatic exposure control circuit, and a second exposure control circuit for setting an exposure period which is an inverse of a frequency of the flicker or a harmonic thereof, and a control circuit for selectively connecting the automatic exposure control circuit and the second exposure control circuit to the main picture area for controlling exposure thereof based upon an output of the filter. --

In the Claims:

Please cancel Claims 1 to 19.

Please add new Claims 20 to 57.

20. A method for detecting lighting flicker in an output of a video imaging device having a main picture area comprising an array of pixels for producing successive images at a frame rate, the method comprising:

producing a series of signals from at least one

additional picture area adjacent the main picture area, the at least one additional picture area having a size substantially larger than a pixel, with each signal being a function of light incident on the at least one additional picture area in a time period substantially shorter than the frame rate;

accumulating a predetermined number of the series of signals to form a series of compound samples; and

filtering the series of compound samples to detect components indicating the lighting flicker.

21. A method according to Claim 20, wherein the time period is equivalent to a line rate of the main picture area.

22. A method according to Claim 20, wherein the at least one additional picture area comprises a plurality of additional picture areas.

23. A method according to Claim 20, wherein the filtering is performed by a bandpass filter tuned to a frequency of the lighting flicker.

24. A method according to Claim 20, wherein each compound sample is formed at a sample rate which is a multiple of a nominal lighting flicker frequency; and wherein the filtering comprises taking a fundamental output component of a radix-N butterfly.

25. A method according to Claim 24, wherein N is equal to at least one of 3 and 4.

26. A method according to Claim 24, wherein the

fundamental output component represents an instantaneous complex lighting flicker energy E, with E being averaged over time to produce a longer term estimate E′ of a lighting flicker energy.

27. A method according to Claim 26, wherein the longer term estimate E′ of the lighting flicker energy is produced according to

$$E' = E\mu + E' (1 - \mu)$$

where μ is a time constant.

28. A method according Claim 26, further comprising:

deriving a modulus of E′; and

comparing the derived modulus to a threshold T to give a final estimation of the lighting flicker being present if $|E'| > T$.

29. A method according Claim 20, further comprising selecting an exposure setting for the main picture area for reducing the lighting flicker.

30. A method for reducing lighting flicker in an output of a video imaging device having a main picture area comprising an array of pixels for producing successive images at a frame rate, the method comprising:

detecting the lighting flicker in the output of the video imaging device, the detecting comprising

producing a series of signals from at least one additional picture area adjacent the main picture

area, the at least one additional picture area having a size substantially larger than a pixel, with each signal being a function of light incident on the at least one additional picture area in a time period substantially shorter than that of the frame rate,

accumulating a predetermined number of the series of signals to form a series of compound samples, and

filtering the series of compound samples to detect components indicating the lighting flicker; and

selecting an exposure setting for the main picture area for reducing the lighting flicker.

31. A method according to Claim 30, wherein selecting the exposure setting comprises selecting an exposure period which is an inverse of a frequency of the lighting flicker.

32. A method according to Claim 31, wherein the frequency of the lighting flicker includes a harmonic thereof.

33. A method according to Claim 30, wherein the time period is equivalent to a line rate of the main picture area.

34. A method according to Claim 30, wherein the at least one additional picture area comprises a plurality of additional picture areas.

35. A method according to Claim 30, wherein the

filtering is performed by a bandpass filter tuned to a frequency of the lighting flicker.

36. A method according to Claim 30, wherein each compound sample is formed at a sample rate which is a multiple of a nominal lighting flicker frequency; and wherein the filtering comprises taking a fundamental output component of a radix-N butterfly.

37. A method according to Claim 36, wherein N is equal to at least one of 3 and 4.

38. A method according to Claim 36, wherein the fundamental output component represents an instantaneous complex lighting flicker energy E, with E being averaged over time to produce a longer term estimate E′ of a lighting flicker energy.

39. A method according to Claim 38, wherein the longer term estimate E′ of the lighting flicker energy is produced according to

$$E' = E\mu + E' \ (1 - \mu)$$

where μ is a time constant.

40. A method according Claim 38, further comprising:

deriving a modulus of E′; and

comparing the derived modulus to a threshold T to give a final estimation of the lighting flicker being present if $|E'| > T$.

41. A method according Claim 30, further comprising selecting an exposure setting for the main picture area for reducing the lighting flicker.

42. A lighting flicker-detecting video camera comprising:

a main picture area comprising an array of pixels for producing successive images at a frame rate;

at least one additional picture area adjacent said main picture area and having a size substantially larger than a pixel, said at least one additional picture area being arranged for producing a series of signals each of which is a function of light incident on said at least one additional picture area in a time period substantially shorter than that of the frame rate;

accumulator means for accumulating a predetermined number of the series of signals to form a series of compound samples; and

filter means for filtering the series of compound samples for detecting components indicating the lighting flicker.

43. A video camera according to Claim 42, wherein said at least one additional picture area is defined by a strip of pixels down one side of said array.

44. A video camera according to Claim 43, wherein the strip of pixels is a column of pixels of said array, with each pixel in the column being connected together.

45. A video camera according to Claim 42, further

comprising:

main gain control means for said main picture area; and

additional gain control means for said at least one additional picture area that is independent of said main gain control means.

46. A video camera according to Claim 42, wherein said filter means comprises a radix-N butterfly.

47. A video camera according to Claim 46, further comprising an averaging circuit connected to an output of the radix-N butterfly.

48. A video camera according to Claim 47, wherein said averaging circuit comprises a first-order auto-regressive filter.

49. A video camera according to Claim 42, further comprising:

an automatic exposure control circuit;

a second exposure control circuit for setting an exposure period which is an inverse of a frequency of the lighting flicker or a harmonic thereof; and

control means for selectively connecting said automatic exposure control circuit and said second exposure control circuit to said main picture area for controlling exposure thereof based upon an output of said filter means.

50. A video camera comprising:

a main picture area comprising an array of pixels

for producing successive images at a frame rate;

at least one additional picture area adjacent said main picture area and having a size substantially larger than a pixel, said at least one additional picture area being arranged for producing a series of signals each of which is a function of light incident on said at least one additional picture area in a time period substantially shorter than that of the frame rate;

an accumulator circuit for accumulating a predetermined number of the series of signals to form a series of compound samples; and

a filter for filtering the series of compound samples for detecting components indicating the lighting flicker.

51. A video camera according to Claim 50, wherein said at least one additional picture area is defined by a strip of pixels down one side of said array.

52. A video camera according to Claim 51, wherein the strip of pixels is a column of pixels of said array, with each pixel in the column being connected together.

53. A video camera according to Claim 50, further comprising:

a main gain control circuit for said main picture area; and

an additional gain control circuit for said at least one additional picture area that is independent of said main gain control circuit.

54. A video camera according to Claim 50, wherein said filter comprises a radix-N butterfly.

55. A video camera according to Claim 54, further comprising an averaging circuit connected to an output of the radix-N butterfly.

56. A video camera according to Claim 55, wherein said averaging circuit comprises a first-order auto-regressive filter.

57. A video camera according to Claim 50, further comprising:

an automatic exposure control circuit;

a second exposure control circuit for setting an exposure period which is an inverse of a frequency of the lighting flicker or a harmonic thereof; and

a control circuit for selectively connecting said automatic exposure control circuit and said second exposure control circuit to said main picture area for controlling exposure thereof based upon an output of said filter.

REMARKS

It is believed that all of the claims are patentable over the prior art. For better readability and the Examiner's convenience, the newly submitted claims differ from the translated counterpart claims which are being canceled. The newly submitted claims do not represent changes or amendments that narrow the claim scope for any reason related to the statutory requirements for patentability. Accordingly, after the Examiner completes a thorough examination and finds the

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claims patentable, a Notice of Allowance is respectfully requested in due course. Should the Examiner determine any minor informalities that need to be addressed, he is encouraged to contact the undersigned attorney at the telephone number below.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached paper is captioned "Version With Markings to Show Changes Made."

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

New paragraphs beginning at page 3, line 27 in the "Summary of the Invention" section have been added as follows:

This and other objects, advantages and features of the present invention are provided by a method for detecting lighting flicker in an output of a video imaging device having a main picture area comprising an array of pixels for producing successive images at a frame rate. The method preferably comprises producing a series of signals from at least one additional picture area adjacent the main picture area. The at least one additional picture area has a size substantially larger than a pixel, with each signal being a function of light incident on the at least one additional picture area in a time period substantially shorter than the frame rate. A predetermined number of the series of signals ar accumulated to form a series of compound samples, and the series of compound samples are filtered to detect components indicating the flicker.

The time period may be equivalent to a line rate of the main picture area. The filtering may be performed by a bandpass filter tuned to a frequency of the flicker. Each compound sample may be formed at a sample rate which is a multiple of a nominal flicker frequency, and wherein the filtering comprises taking a fundamental output component of a radix-N butterfly. The method preferably further includes selecting an exposure setting for the main picture area for reducing the flicker.

Another aspect of the present relates to a flicker-

detecting video camera comprising a main picture area comprising an array of pixels for producing successive images at a frame rate, and at least one additional picture area adjacent the main picture area. The at least one additional picture area may have a size substantially larger than a pixel, and the at least one additional picture area may be arranged for producing a series of signals each of which is a function of light incident on the at least one additional picture area in a time period substantially shorter than that of the frame rate.

The video camera preferably further includes an accumulator circuit for accumulating a predetermined number of the series of signals to form a series of compound samples, and a filter for filtering the series of compound samples for detecting components indicating the flicker.

The at least one additional picture area may be defined by a strip of pixels down one side of the array. In one embodiment, the strip of pixels is a column of pixels of the array, with each pixel in the column being connected together.

The video camera may further comprises an automatic exposure control circuit, and a second exposure control circuit for setting an exposure period which is an inverse of a frequency of the flicker or a harmonic thereof, and a control circuit for selectively connecting the automatic exposure control circuit and the second exposure control circuit to the main picture area for controlling exposure thereof based upon an output of the filter.

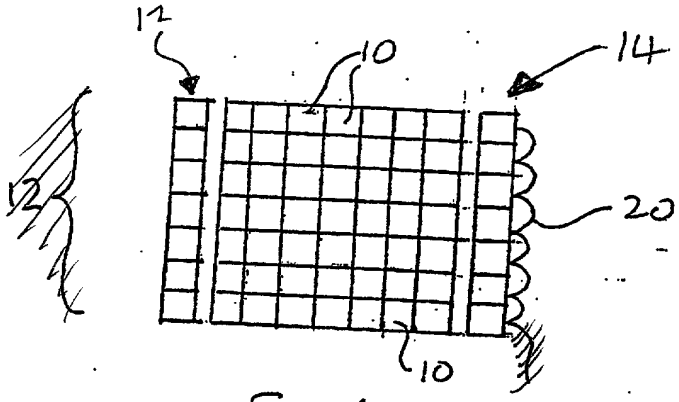

Fig. 1

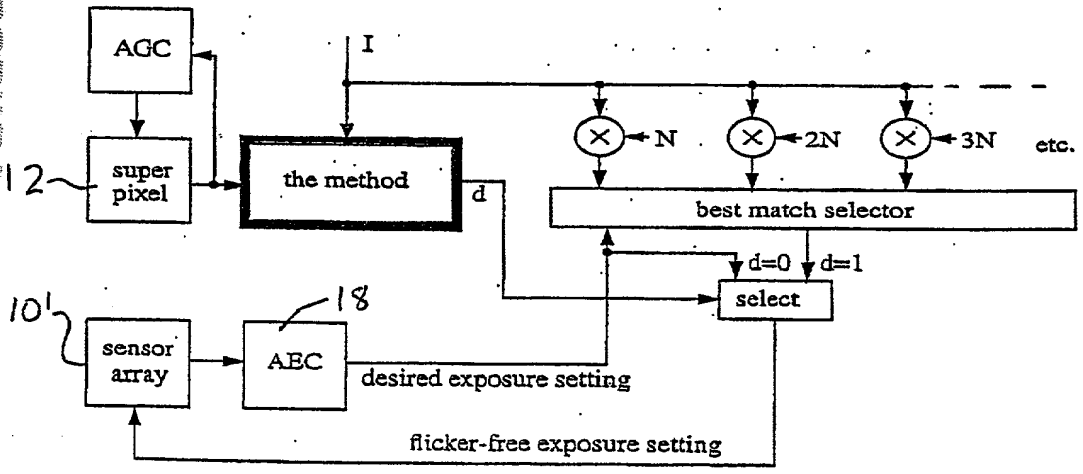

Figure 4 use of the method in a flicker-detecting video camera

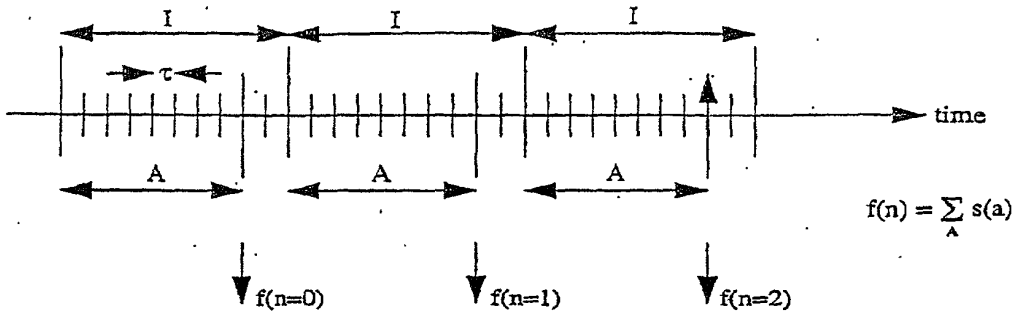

Figure 2 compound sampling interval and aperture

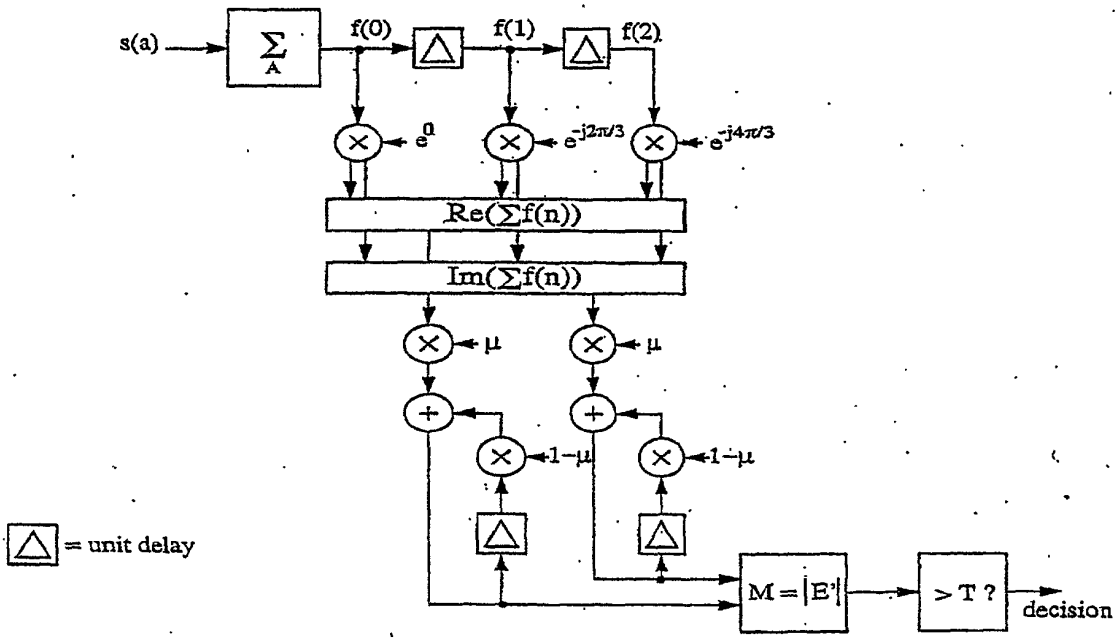

Figure 3 block diagram of flicker detection method